U.S. Energy Information Administration

December 2010

Changes in *Natural Gas Monthly* Consumption Data Collection and the *Short-Term Energy Outlook*[1]

Introduction

Beginning with the December 2010 issue of the *Short-Term Energy Outlook* (*STEO*), the Energy Information Administration (EIA) will present natural gas consumption forecasts for the residential and commercial sectors that are consistent with recent changes to the Form EIA-857 monthly natural gas survey. Firms are now reporting natural gas deliveries on the Form EIA-857 survey on a calendar-month basis, which should reduce the seasonality in the natural gas balancing item, which reflects the difference between total disposition and total supply at a national level. Issues surrounding the balancing item and the measures being taken to address them were discussed in Seasonality in the Natural Gas Balancing Item: Historical Trends and Corrective Measures, June 4, 2010. This *STEO* supplement reviews the expected effects of the Form EIA-857 survey changes and the related revisions to the *Short-Term Energy Outlook* models and reports.

Natural Gas Balancing Item and Form EIA-857 Survey Revisions

The natural gas balancing item, as reported in the EIA's *Natural Gas Monthly* (*NGM*), reflects the difference between total disposition (consumption, exports, and storage injections) and total supply (production, imports, and stock draws) at a national level. A positive balancing item indicates that disposition exceeds supply while a negative balancing item indicates that supply exceeds disposition. EIA's balancing item has, for several years, followed a strong seasonal pattern (Figure 1). In the fall months the balancing item tended to be negative; while in the spring it tended to be positive.

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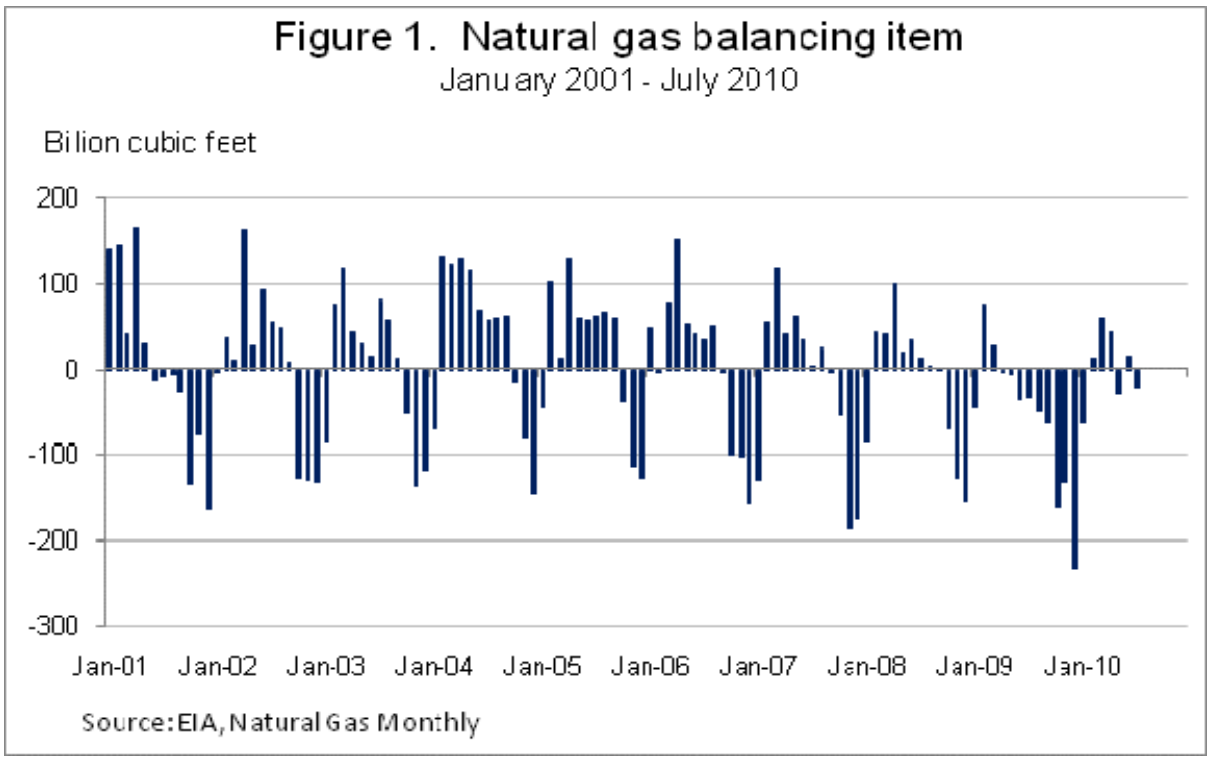


EIA's primary natural gas consumption survey is Form EIA-857, "Monthly Report of Natural Gas Purchases and Deliveries to Consumers". Through respondent site visits EIA determined that much of the seasonality in the balancing item was attributable to data-reporting practices of local distribution companies (LDCs) on the Form EIA-857 survey. Many LDCs reported sales to their residential and commercial customers corresponding to their billing cycle rather than the actual calendar month. When submitting Form EIA-857, LDCs often summed usage data read from meters during the calendar month. Meters read in the beginning or middle of the month reflected usage from at least part of the previous month.

Natural gas supplies, on the other hand, are reported on a calendar-month basis. Consequently, there may be significant differences between total supply and disposition, as indicated by the monthly balancing item because consumption data are reported with an underlying lag. For example, if EIA is collecting natural gas data for the month of April (a typically low month of consumption) and an LDC's "April" billing cycle represents March 15 – April 15, reported consumption volumes for April will be higher than their actual levels, since March consumption generally exceeds April consumption.

Residential and commercial customers primarily use natural gas as a heating fuel; thus, residential and commercial consumption is strongly seasonal, driven by weather patterns and

heating degree-days (HDDs).[2] During the spring and fall, when weather is changing, the balancing item is generally largest because of the lag in reported consumption data. The lags in the survey data raise reported consumption during the spring months and reduce consumption during the fall months and above or below levels that actually occurred during the calendar month. As the difference in HDDs between months increases the absolute size of the balancing item will increase. EIA analysis indicates that the consumption reporting lags and seasonality in HDDs may account for nearly 80 percent of the total variability in the balancing.

EIA recently implemented Form EIA-857 survey revisions to correct for the lag in reported data – and thereby reduce the seasonality in the balancing item – by collecting data on monthly sendout volumes by LDCs and pipelines. Using sendout data, which reflects actual deliveries rather than billed deliveries, provides a more accurate measure of aggregate natural gas deliveries during each calendar month.[3] Sendout-based data were first reported in the *NGM* in the October edition, released October 29, 2010, which reports data through August 2010.

While reported volumes will now correspond to the sendout volumes, sector-level prices published in the *NGM* will continue to correspond to LDC billing cycles, since billing data represents the only source of an LDC's revenue stream. EIA considered a number of other methods for calculating prices, but deemed this one the most accurate.

Changes to the *Short-Term Energy Outlook* Forecasting Model

The new *STEO* forecast for commercial and residential consumption is based on an estimated history of consumption, which is described below. The new methodology will be reflected in this month's *STEO*, which forecasts natural gas consumption beginning in October 2010.

Historical consumption is used in the *STEO* model to forecast future consumption. In order to forecast consumption as it will appear in the *NGM*, the *STEO* must use a revised data history for theoretical consistency. Since practical limitations prevent EIA from re-surveying to create a history using the new survey methodology, the *STEO* will use two estimated data histories (one for residential and one for commercial) to approximate what consumption might have been over the past several years based on sendout volumes. Tables of the new data histories are available in the Appendix.

Since residential and commercial consumption are largely a function of HDDs, the estimated history will be largely based on HDDs. The consumption estimates are done at the state level

[2] A heating degree-day is a measure of how cold a location is over a period of time relative to a base temperature, most commonly specified as 65 degrees Fahrenheit. The measure is computed for each day by subtracting the average of the day's high and low temperatures from the base temperature (65 degrees), with negative values set equal to zero. Each day's heating degree-days are summed to create a heating degree-day measure for a specified reference period. Heating degree-days are used in energy analysis as an indicator of space heating energy requirements or use.

[3] Sendout data will give better aggregate totals but may cost precision in terms of sectoral data. It captures natural gas going into the distribution system without specifying the end-use sector for which it is intended.

with total U.S. consumption equal to the sum of estimated state-level consumption volumes. The estimated monthly consumption volumes per state in a calendar month are given by Equation (1):

$$C_{state,\,sector} = Vol_{min} + Vol_{heating} \quad \text{(Eq. 1)}$$

$C_{state,sector}$ represents the estimated consumption during the calendar month in a given state and sector (either commercial or residential). Vol_{min} represents the minimum monthly volume of natural gas consumption for either the commercial or residential sector (the volume of natural gas that is always consumed in a given calendar month assuming minimal use for heating); $Vol_{heating}$ represents the amount of natural gas used for space heating during a calendar month, which is a function of HDDs. Vol_{min} can be thought of as a fixed component to natural gas consumption, while $Vol_{heating}$ can be thought of as the variable component.

Vol_{min} is the lowest monthly consumption volume in a given year.[4] August consumption is generally the month in which the lowest volume of natural gas is consumed in most states.

The $Vol_{heating}$ component of the estimated monthly consumption is calculated using Equation (2):

$$Vol_{heating} = HDD_{adj} * Vol_{HDD} \quad \text{(Eq 2)}$$

HDD_{adj} represents monthly total heating degree-days that have been adjusted by a correction factor. A series of HDD correction factors were tested to see if the resulting estimated monthly consumption volumes reduced the variance in the resulting monthly balancing item. Equation (3) reflects the optimal downward adjustment in actual total monthly heating degree-days (HDD_{actual}) of 95 degree-days with the restriction that HDD_{adj} is greater than or equal to zero. The HDD adjustment essentially reduces the base temperature from which HDDs are calculated from 65 degrees to about 62 degrees. This correction may reflect increasing thermal efficiency of housing and increasing use of heat-emitting home electronics since the HDD calculations were first derived. More rigorous testing of this adjustment may be possible once a sufficient history of actual sendout volume data is collected.

$$HDD_{adj} = max(HDD_{actual} - 95,\, 0) \quad \text{(Eq 3)}$$

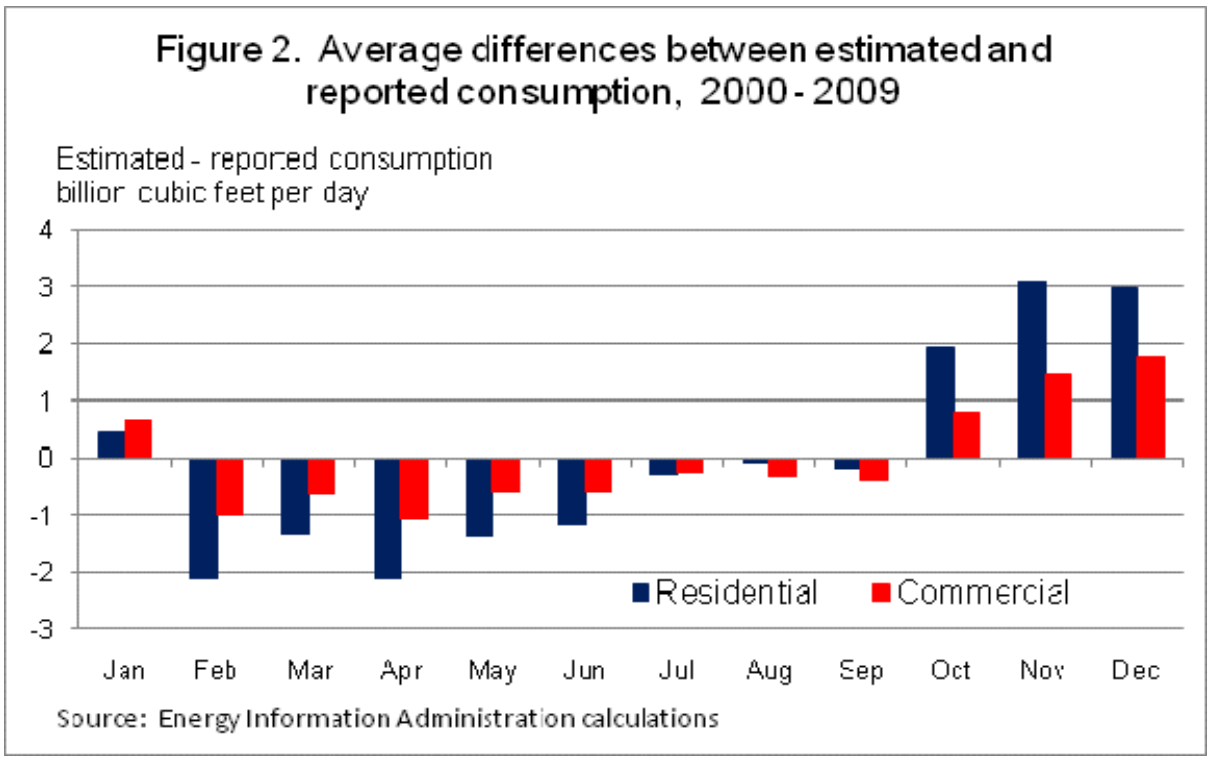
Vol_{HDD} represents the monthly volume of natural gas (above the minimum volume) per HDD that occurs over a season. The volume per HDD is calculated in Equation 4 as the sum of the monthly differences between reported monthly volumes (Vol_i) and the seasonal monthly minimum volume (Vol_{min}) divided by the sum of HDDs for the seasonal year (August through July) in each state.

$$Vol_{HDD} = \frac{\sum_{t=1}^{12}(Vol_t - Vol_{min})}{\sum HDD_t} \quad \text{(Eq 4)}$$

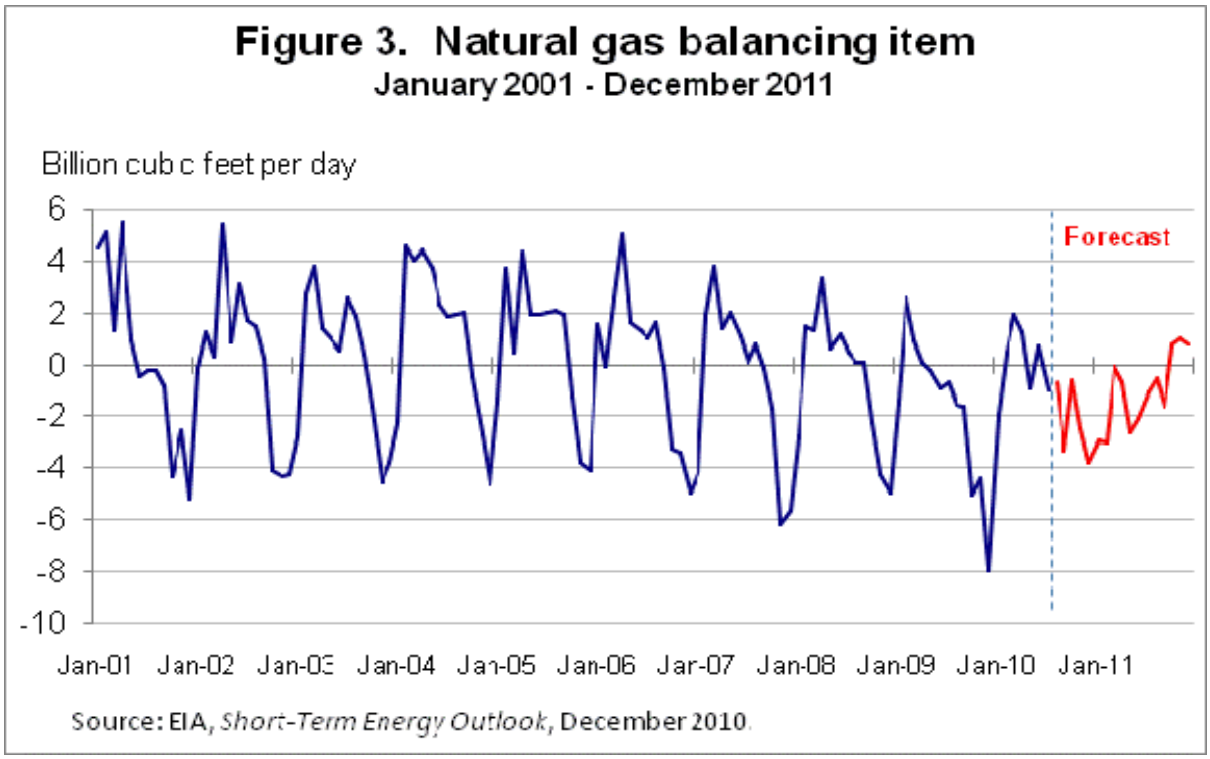
[4] "Year" does not mean the traditional calendar year; rather, the year is a seasonal year running from August through July.

For example, assume the minimum natural gas usage is 0.66 million cubic feet per day (MMcf/d in August in a given year in a given state. Then assume the natural gas usage in March is 1.70 MMcf/day. The volume above the minimum in March is 1.04 MMcf/d (1.70– .66). This same calculation is performed for each month in the seasonal year. The sum of the differences between the actual volumes and the minimum volumes is converted to an aggregate annual volume. Assume that 250,460 million cubic feet (MMcf) of natural gas above the minimum is consumed during the seasonal year. This total seasonal volume above the minimum is then divided by the sum of the adjusted HDDs for that same (seasonal) year, assumed to be 1900 in this case. This would imply that for each HDD in a given month, an additional 132 MMcf of natural gas would be consumed above the minimum (non-heating-related) natural gas consumption for each month.

The estimated consumption history reduces the seasonality in the balancing item by reducing volumes in the spring and increasing volumes in the fall. Figure 2 presents the average differences between the new estimated consumption history and monthly consumption reported in the *NGM* based on billing-cycle data. Estimated consumption during the spring months is lower and the balancing item, which was generally greater than zero during those months, is reduced. Estimated monthly consumption during the fall months is higher and the balancing item, which was generally negative during those months, is increased.



Since the new Form EIA-857 survey methodology should result in less seasonality in the balancing item, so should the new *STEO* forecast, which is based on the new estimated historical monthly consumption (Figure 3).



Changes to the *Short-Term Energy Outlook* Reports

Although the *STEO* will forecast based on an estimated history, historical consumption data reported in both the *NGM* and *STEO* will not change. Consequently there will be a change in the seasonality of residential and commercial consumption and the balancing item after July 2010. There are two significant implications of this change in the Form EIA-857 survey methodology. First, year-over-year comparisons of monthly consumption and the balancing item cannot be made for August 2010 through July 2011. For example, residential and commercial consumption reported for December 2010 cannot be compared directly with consumption reported for December 2009 because of the revisions to the survey methodology. For example, if this December is colder than last December, the increase in residential consumption from December 2009 to December 2010 will likely significantly exceed the change one might expect based on the increase in HDDs.

Second, because the change is during the course of 2010, reported consumption over the first part of 2010 will be on the old billing-cycle basis while consumption over the second part of the year will be on the new sendout basis. Thus, total 2010 consumption will be higher than it would

normally be if the entire year were measured on a consistent basis. In other words, first quarter 2010 consumption will be biased upwards because of the lagged billing effect, but fourth quarter 2010 consumption will not have the historical offsetting downward bias.

The *STEO* will no longer publish Table 5b, U.S. Regional Natural Gas Consumption. The primary purpose of the regional natural gas consumption volumes was for weighting regional prices in the calculation of quarterly or annual averages. The *NGM* will now report residential and commercial consumption volumes by State based on the new sendout data. However, these volumes will not necessarily be consistent with the reported state and regional prices. Fixed costs can make up a significant portion of the average natural gas retail price. Consequently, as natural gas consumption rises the average retail price of natural gas can fall. Typically, residential retail prices are lower during the winter months (when consumption is highest) than during the summer months. Residential and commercial average retail prices will still be reported in the EIA-857 survey and in the *NGM* based on sales during the billing-cycle. Hence, the average retail natural gas price reported for a given month may not be consistent with the reported sendout volume when the sendout volume is greater or less than the billing volume for that month. The *STEO* will continue to report regional natural gas end-use prices by sector (previously published as Table 5c and now renumbered as Table 5b).

Appendix

Table A1. Estimated calendar-month U.S. natural gas consumption in the residential sector (billion cubic feet per day)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2000	29.304	22.303	16.950	11.966	5.320	3.808	3.722	3.822	4.363	8.794	20.860	32.897
2001	30.388	25.688	21.719	10.527	5.231	3.916	3.806	3.668	4.152	9.235	13.787	23.509
2002	26.349	24.885	21.215	10.307	7.186	3.721	3.666	3.720	3.883	10.533	19.511	27.284
2003	31.558	29.492	19.405	12.213	6.645	3.784	3.711	3.707	4.080	9.590	16.968	26.867
2004	32.881	27.131	16.747	10.544	5.046	3.795	3.701	3.791	3.993	8.862	16.909	26.625
2005	28.567	24.145	21.114	10.672	6.913	3.900	3.779	3.545	3.710	7.998	15.681	27.844
2006	21.940	25.551	18.995	9.310	5.342	3.564	3.548	3.481	4.155	10.108	15.821	22.957
2007	28.132	30.715	16.395	12.394	4.808	3.563	3.478	3.575	3.804	6.481	17.423	25.856
2008	28.721	25.282	19.823	10.995	6.997	3.733	3.578	3.529	3.819	9.529	17.645	26.741
2009	30.400	24.048	18.276	11.248	5.407	3.635	3.524	3.464	3.751	11.024	14.783	27.963
2010	29.760	28.359	17.664	9.131	5.457	3.579	3.462					

Table A2. Estimated calendar-month U.S. natural gas consumption in the commercial sector (billion cubic feet per day)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2000	16.121	12.725	10.152	7.878	4.831	4.096	4.052	4.042	4.323	6.382	11.787	17.526
2001	16.185	13.973	12.245	7.027	4.714	4.079	4.005	4.006	4.252	6.710	8.732	13.153
2002	14.697	14.140	12.161	7.056	5.616	4.038	4.011	3.881	3.972	7.274	11.577	15.251
2003	17.504	16.384	11.515	7.957	5.329	3.928	3.892	3.968	4.160	6.818	10.106	14.795
2004	17.725	14.943	10.194	7.225	4.627	4.004	3.948	3.851	3.963	6.302	9.922	14.589
2005	15.530	13.485	11.998	6.988	5.345	3.905	3.844	3.800	3.886	5.925	9.472	15.141
2006	12.311	14.102	10.791	6.354	4.635	3.807	3.798	3.868	4.212	7.005	9.563	12.694
2007	15.106	16.554	9.887	7.998	4.496	3.909	3.865	3.836	3.966	5.263	10.563	14.486
2008	16.024	14.271	11.664	7.407	5.488	3.919	3.832	3.917	4.088	6.896	10.700	14.801
2009	16.799	13.682	10.901	7.553	4.863	3.983	3.916	3.834	3.987	7.653	9.210	15.273
2010	16.293	15.629	10.502	6.461	4.728	3.897	3.830					

Source: EIA calculations.